

## CLAIMS

What is claimed is:

1. A process for the preparation of a chlortetracycline-containing animal feed composition, comprising the steps of:
  - 5 (a) providing first and second quantities of fermentation broth comprising chlortetracycline, said first and second quantities of fermentation broth produced by fermentation of an organism producing chlortetracycline, said first and second quantities of fermentation broth comprising fermentation solids and liquids;
  - 10 (b) adjusting the pH of the first quantity of fermentation broth to a value of about 7 or greater and adding a chlortetracycline complexing compound in an amount sufficient to produce fermentation broth containing complexed chlortetracycline;
  - 15 (c) lowering the pH of said second quantity of fermentation broth to a level sufficient to dissolve the chlortetracycline in said second quantity of fermentation broth;
  - (d) removing solids from said pH-adjusted second quantity of fermentation broth and collecting liquid containing dissolved chlortetracycline;
  - (e) adjusting the pH of said liquid containing dissolved chlortetracycline to a value of about 7 or greater and adding a chlortetracycline complexing compound in an amount sufficient to produce a suspension of complexed chlortetracycline;
  - 20 (f) mixing said fermentation broth containing complexed chlortetracycline from step (b) and said suspension of complexed chlortetracycline from step (e);
  - 25 (g) removing liquids from the mixture of step (f) to produce a complexed chlortetracycline-containing fermentation product having a low moisture content; and

(h) sizing said low moisture content fermentation product to produce a particulate chlortetracycline-containing fermentation product having a predetermined particle size or range of particle sizes.

2. A process according to claim 1, wherein the ratio of said first quantity of fermentation broth to said second quantity of fermentation broth is from about 1:10 to about 10:1.

3. A process according to claim 1, wherein the ratio of said first quantity of fermentation broth to said second quantity of fermentation broth is from about 1:5 to about 5:1.

4. A process according to claim 1, wherein the ratio of said first quantity of fermentation broth to said second quantity of fermentation broth is from about 1:3 to about 3:1.

5. A process according to claim 1, wherein the first quantity of fermentation broth and the second quantity of fermentation broth are from the same fermentation batch.

6. A process according to claim 1, wherein the first quantity of fermentation broth and the second quantity of fermentation broth are from different fermentation batches.

7. A process according to claim 1, wherein the chlortetracycline complexing compound added to said first quantity of fermentation broth is calcium carbonate.

8. A process according to claim 1, wherein the pH of the first quantity of fermentation broth is adjusted by the addition of aqueous ammonia.

9. A process according to claim 1, wherein the pH of the first quantity of fermentation broth is adjusted to a value of from about 7.5 to about 8.0.

10. A process according to claim 1, wherein the pH of the second quantity of fermentation broth is adjusted by adding a mineral acid.

11. A process according to claim 1, wherein the pH of the second quantity of fermentation broth is adjusted by adding one or more acids selected from the group consisting of oxalic acid, hydrochloric acid, and sulfuric acid.

12. A process according to claim 1, wherein the pH of the second quantity of fermentation broth is adjusted to a value of about 4.0 or less.

13. A process according to claim 1, wherein the pH of the second quantity of fermentation broth is adjusted to a value of about 2.0 or less.

14. A process according to claim 1, wherein the pH of the second quantity of fermentation broth is adjusted to a value of about 1.0 to about 1.3.

15. A process according to claim 1, wherein said chlortetracycline complexing compound added to said liquid containing dissolved chlortetracycline is calcium carbonate and the pH of said liquid containing dissolved chlortetracycline is adjusted by the addition of aqueous ammonia.

16. A process according to claim 1, wherein the pH of said liquid containing dissolved chlortetracycline is adjusted to a pH of from about 7.5 to about 8.0.

17. A process according to claim 1, wherein the removal of liquids in step (g) utilizes one or more of the following: a filter press, centrifugal filter, rotary vacuum filter, oven, tray dryer, tunnel dryer, spray dryer, spray granulator, fluid bed dryer, shelf dryer, drum dryer, rotary dryer, microwave dryer, and contact dryer.

18. A process according to claim 1, wherein the removal of liquids in step (g) utilizes at least one of: a filter press, a centrifuge, and an oven.

19. A process according to claim 1, wherein said filter cake is dried to a moisture content of from about 2% to about 12%.

20. A process according to claim 1, wherein said filter cake is dried to a moisture content of from about 2% to about 6%.

21. A process according to claim 1, wherein said low moisture content fermentation product comprises chlortetracycline in an amount from about 30% to about 75%.

22. A process according to claim 1, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 35% to about 65%.

23. A process according to claim 1, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 44% to about 55%.

5 24. A process according to claim 1, wherein said particles are in the form of a powder, meal, pellets, granules, or tablets.

25. A process according to claim 1, wherein said particles have a diameter of from about 150  $\mu\text{m}$  to about 2 mm.

10 26. A process according to claim 1, wherein said particles are produced without any compression or compaction step.

27. A process according to claim 1, wherein said particles are produced with a compression or compaction step.

28. A process according to claim 1, further comprising the step of blending said particulate chlortetracycline-containing fermentation product with at least one diluent selected from the group consisting of an edible feed material, a mineral product, and an oil.

29. A process according to claim 28, further comprising the step of admixing said granules with a nonmedicated animal feedstuff.

30. A process according to claim 28, wherein said edible feed material is rice hulls.

31. A process according to claim 28, wherein said mineral product is limestone.

32. A process according to claim 28, wherein said oil is mineral oil.

33. A process for the preparation of a chlortetracycline-containing animal feed composition, comprising the steps of:

- (a) providing first and second quantities of fermentation broth comprising chlortetracycline, said first and second quantities of fermentation broth produced by fermentation of an organism producing chlortetracycline, said first and second quantities of fermentation broth comprising fermentation solids and liquids;
- (b) lowering the pH of said second quantity of fermentation broth to a level sufficient to dissolve the chlortetracycline in said second quantity of fermentation broth;
- (c) removing solids from said pH-adjusted second quantity of fermentation broth and collecting liquid containing dissolved chlortetracycline;
- (d) mixing said liquid containing dissolved chlortetracycline with said first quantity of fermentation broth to produce a mixture;
- (e) adjusting the pH of the mixture of step (d) to a value of about 7 or greater and adding a chlortetracycline complexing compound in an amount sufficient to complex the chlortetracycline in the mixture;
- (f) removing liquids from the mixture of step (e) to produce a complexed chlortetracycline-containing fermentation product having a low moisture content; and
- (h) sizing said low moisture content fermentation product to produce a particulate chlortetracycline-containing fermentation product having a predetermined particle size or range of particle sizes.

34. A process according to claim 33, wherein the ratio of said first quantity of fermentation broth to said second quantity of fermentation broth is from about 1:10 to about 10:1.

35. A process according to claim 33, wherein the ratio of said first quantity of fermentation broth to said second quantity of fermentation broth is from about 1:5 to about 5:1.

36. A process according to claim 33, wherein the ratio of said first quantity of fermentation broth to said second quantity of fermentation broth is from about 1:3 to about 3:1.

37. A process according to claim 33, wherein the first quantity of fermentation broth and the second quantity of fermentation broth are from the same fermentation batch.

38. A process according to claim 33, wherein the first quantity of fermentation broth and the second quantity of fermentation broth are from different fermentation batches.

39. A process according to claim 33, wherein the chlortetracycline complexing compound added to said first quantity of fermentation broth is calcium carbonate.

40. A process according to claim 33, wherein the pH of the mixture is adjusted in step (e) by the addition of aqueous ammonia.

41. A process according to claim 33, wherein the pH of the mixture is adjusted in step (e) to a value of from about 7.5 to about 8.0.

42. A process according to claim 33, wherein the pH of the second quantity of fermentation broth is adjusted by adding a mineral acid.

43. A process according to claim 33, wherein the pH of the second quantity of fermentation broth is adjusted by adding one or more acids selected from the group consisting of oxalic acid, hydrochloric acid, and sulfuric acid.

44. A process according to claim 33, wherein the pH of the second quantity of fermentation broth is adjusted to a value of about 4.0 or less.

45. A process according to claim 33, wherein the pH of the second quantity of fermentation broth is adjusted to a value of about 2.0 or less.

46. A process according to claim 33, wherein the pH of the second quantity of fermentation broth is adjusted to a value of about 1.0 to about 1.3.

47. A process according to claim 33, wherein the removal of liquids in step (g) utilizes one or more of the following: a filter press, centrifugal filter, rotary

vacuum filter, oven, tray dryer, tunnel dryer, spray dryer, spray granulator, fluid bed dryer, shelf dryer, drum dryer, rotary dryer, microwave dryer, and contact dryer.

48. A process according to claim 33, wherein the removal of liquids in step (g) utilizes at least one of: a filter press, a centrifuge, and an oven.

5 49. A process according to claim 33, wherein said filter cake is dried to a moisture content of from about 2% to about 12%.

50. A process according to claim 33, wherein said filter cake is dried to a moisture content of from about 2% to about 6%.

10 51. A process according to claim 33, wherein said low moisture content fermentation product comprises chlortetracycline in an amount from about 30% to about 75%.

52. A process according to claim 33, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 35% to about 65%.

15 53. A process according to claim 33, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 44% to about 55%.

54. A process according to claim 33, wherein said particles are in the form of a powder, meal, pellets, granules, or tablets.

20 55. A process according to claim 33, wherein said particles have a diameter of from about 150  $\mu$ m to about 2 mm.

56. A process according to claim 33, wherein said particles are produced without any compression or compaction step.

25 57. A process according to claim 33, wherein said particles are produced with a compression or compaction step.

58. A process according to claim 33, further comprising the step of blending said particulate chlortetracycline-containing fermentation product with at least one diluent selected from the group consisting of an edible feed material, a mineral product, and an oil.





63. A process for the preparation of a chlortetracycline-containing animal feed composition, comprising the steps of:

- (a) providing first and second quantities of fermentation broth comprising chlortetracycline, said first and second quantities of fermentation broth produced by fermentation of an organism producing chlortetracycline, said first and second quantities of fermentation broth comprising fermentation solids and liquids;
- (b) adjusting the pH of the first quantity of fermentation broth to a value of about 7 or greater to produce fermentation broth containing chlortetracycline in the free base form;
- (c) lowering the pH of said second quantity of fermentation broth to a level sufficient to dissolve the chlortetracycline in said second quantity of fermentation broth;
- (d) removing solids from said pH-adjusted second quantity of fermentation broth and collecting liquid containing dissolved chlortetracycline;
- (e) adjusting the pH of said liquid containing dissolved chlortetracycline to a value of about 7 or greater to produce a suspension of chlortetracycline in the free base form;
- (f) mixing said fermentation broth containing chlortetracycline in the free base from step (b) and said suspension of chlortetracycline in the free base form from step (e);
- (g) removing liquids from the mixture of step (f) to produce a fermentation product having a low moisture content containing chlortetracycline in the free base form; and
- (h) sizing said low moisture content fermentation product to produce a particulate fermentation product containing chlortetracycline in the free base form having a predetermined particle size or range of particle sizes.

64. A process according to claim 63, wherein the ratio of said first quantity of fermentation broth to said second quantity of fermentation broth is from about 1:10 to about 10:1.

65. A process according to claim 63, wherein the ratio of said first quantity of fermentation broth to said second quantity of fermentation broth is from about 1:5 to about 5:1.

66. A process according to claim 63, wherein the ratio of said first quantity of fermentation broth to said second quantity of fermentation broth is from about 1:3 to about 3:1.

67. A process according to claim 63, wherein the first quantity of fermentation broth and the second quantity of fermentation broth are from the same fermentation batch.

68. A process according to claim 63, wherein the first quantity of fermentation broth and the second quantity of fermentation broth are from different fermentation batches.

69. A process according to claim 63, wherein the pH of the first quantity of fermentation broth is adjusted by the addition of aqueous ammonia.

70. A process according to claim 63, wherein the pH of the first quantity of fermentation broth is adjusted to a value of from about 7.5 to about 8.0.

71. A process according to claim 63, wherein the pH of the second quantity of fermentation broth is adjusted by adding a mineral acid.

72. A process according to claim 63, wherein the pH of the second quantity of fermentation broth is adjusted by adding one or more acids selected from the group consisting of oxalic acid, hydrochloric acid, and sulfuric acid.

73. A process according to claim 63, wherein the pH of the second quantity of fermentation broth is adjusted to a value of about 4.0 or less.

74. A process according to claim 63, wherein the pH of the second quantity of fermentation broth is adjusted to a value of about 2.0 or less.

75. A process according to claim 63, wherein the pH of the second quantity of fermentation broth is adjusted to a value of about 1.0 to about 1.3.

76. A process according to claim 63, wherein the pH of said liquid containing dissolved chlortetracycline is adjusted by the addition of aqueous ammonia.

77. A process according to claim 63, wherein the pH of said liquid containing dissolved chlortetracycline is adjusted to a pH of from about 7.5 to about 8.0.

78. A process according to claim 63, wherein the removal of liquids in step (g) utilizes one or more of the following: a filter press, centrifugal filter, rotary vacuum filter, oven, tray dryer, tunnel dryer, spray dryer, spray granulator, fluid bed dryer, shelf dryer, drum dryer, rotary dryer, microwave dryer, and contact dryer.

79. A process according to claim 63, wherein the removal of liquids in step (g) utilizes at least one of: a filter press, a centrifuge, and an oven.

80. A process according to claim 63, wherein said filter cake is dried to a moisture content of from about 2% to about 12%.

81. A process according to claim 63, wherein said filter cake is dried to a moisture content of from about 2% to about 6%.

82. A process according to claim 63, wherein said low moisture content fermentation product comprises chlortetracycline in an amount from about 30% to about 75%.

83. A process according to claim 63, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 35% to about 65%.

84. A process according to claim 63, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 44% to about 55%.

85. A process according to claim 63, wherein said particles are in the form of a powder, meal, pellets, granules, or tablets.

86. A process according to claim 63, wherein said particles have a diameter of from about 150  $\mu\text{m}$  to about 2 mm.

87. A process according to claim 63, wherein said particles are produced without any compression or compaction step.

5 88. A process according to claim 63, wherein said particles are produced with a compression or compaction step.

89. A process according to claim 63, further comprising the step of blending said particulate chlortetracycline-containing fermentation product with at least one diluent selected from the group consisting of an edible feed material, a mineral product, and an oil.

90. A process according to claim 89, further comprising the step of admixing said granules with a nonmedicated animal feedstuff.

91. A process according to claim 89, wherein said edible feed material is rice hulls.

92. A process according to claim 89, wherein said mineral product is limestone.

93. A process according to claim 89, wherein said oil is mineral oil.

94. A process for the preparation of a chlortetracycline-containing animal feed composition, comprising the steps of:

- (a) providing first and second quantities of fermentation broth comprising chlortetracycline, said first and second quantities of fermentation broth produced by fermentation of an organism producing chlortetracycline, said first and second quantities of fermentation broth comprising fermentation solids and liquids;
- (b) lowering the pH of said second quantity of fermentation broth to a level sufficient to dissolve the chlortetracycline in said second quantity of fermentation broth;
- (c) removing solids from said pH-adjusted second quantity of fermentation broth and collecting liquid containing dissolved chlortetracycline;
- (d) mixing said liquid containing dissolved chlortetracycline with said first quantity of fermentation broth to produce a mixture;
- (e) adjusting the pH of the mixture of step (d) to a value of about 7 or greater to form mixture containing chlortetracycline in the free base form;
- (f) removing liquids from the mixture of step (e) to produce a fermentation product containing chlortetracycline in the free base form having a low moisture content; and
- (h) sizing said low moisture content fermentation product to produce a particulate chlortetracycline-containing fermentation product having a predetermined particle size or range of particle sizes.

95. A process according to claim 94, wherein the ratio of said first quantity of fermentation broth to said second quantity of fermentation broth is from about 1:10 to about 10:1.

96. A process according to claim 94, wherein the ratio of said first quantity of fermentation broth to said second quantity of fermentation broth is from about 1:5 to about 5:1.

97. A process according to claim 94, wherein the ratio of said first quantity of fermentation broth to said second quantity of fermentation broth is from about 1:3 to about 3:1.

98. A process according to claim 94, wherein the first quantity of fermentation broth and the second quantity of fermentation broth are from the same fermentation batch.

99. A process according to claim 94, wherein the first quantity of fermentation broth and the second quantity of fermentation broth are from different fermentation batches.

100. A process according to claim 94, wherein the pH of the mixture is adjusted in step (e) by the addition of aqueous ammonia.

101. A process according to claim 94, wherein the pH of the mixture is adjusted in step (e) to a value of from about 7.5 to about 8.0.

102. A process according to claim 94, wherein the pH of the second quantity of fermentation broth is adjusted by adding a mineral acid.

103. A process according to claim 94, wherein the pH of the second quantity of fermentation broth is adjusted by adding one or more acids selected from the group consisting of oxalic acid, hydrochloric acid, and sulfuric acid.

104. A process according to claim 94, wherein the pH of the second quantity of fermentation broth is adjusted to a value of about 4.0 or less.

105. A process according to claim 94, wherein the pH of the second quantity of fermentation broth is adjusted to a value of about 2.0 or less.

106. A process according to claim 94, wherein the pH of the second quantity of fermentation broth is adjusted to a value of about 1.0 to about 1.3.

107. A process according to claim 94, wherein the removal of liquids in step (g) utilizes one or more of the following: a filter press, centrifugal filter, rotary vacuum filter, oven, tray dryer, tunnel dryer, spray dryer, spray granulator, fluid bed dryer, shelf dryer, drum dryer, rotary dryer, microwave dryer, and contact dryer.

108. A process according to claim 94, wherein the removal of liquids in step (g) utilizes at least one of: a filter press, a centrifuge, and an oven.

109. A process according to claim 94, wherein said filter cake is dried to a moisture content of from about 2% to about 12%.

5 110. A process according to claim 94, wherein said filter cake is dried to a moisture content of from about 2% to about 6%.

111. A process according to claim 94, wherein said low moisture content fermentation product comprises chlortetracycline in an amount from about 30% to about 75%.

10 112. A process according to claim 94, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 35% to about 65%.

113. A process according to claim 94, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 44% to about 55%.

114. A process according to claim 94, wherein said particles are in the form of a powder, meal, pellets, granules, or tablets.

115. A process according to claim 94, wherein said particles have a diameter of from about 150  $\mu$ m to about 2 mm.

116. A process according to claim 94, wherein said particles are produced without any compression or compaction step.

117. A process according to claim 94, wherein said particles are produced with a compression or compaction step.

118. A process according to claim 94, further comprising the step of blending said particulate chlortetracycline-containing fermentation product with at least one diluent selected from the group consisting of an edible feed material, a mineral product, and an oil.

119. A process according to claim 118, further comprising the step of admixing said granules with a nonmedicated animal feedstuff.

120. A process according to claim 118, wherein said edible feed material is rice hulls.

121. A process according to claim 118, wherein said mineral product is limestone.

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122. A process according to claim 118, wherein said oil is mineral oil.

120. A process according to claim 118, wherein said edible feed material is rice hulls.



123. An apparatus for the preparation of a chlortetracycline-containing animal feed composition from fermentation broth, said fermentation broth produced by fermentation of an organism producing chlortetracycline, said fermentation broth comprising chlortetracycline, fermentation solids and liquids, the apparatus comprising:

a first conduit comprising an inlet which connects to a source of fermentation broth, said conduit comprising a first outlet, a second outlet, and a control valve for directing a first quantity of said fermentation broth to said first outlet, and a second quantity of said fermentation broth to said second outlet;

a first complexing tank comprising an inlet for receiving said first quantity of the fermentation broth from the first outlet of said conduit, said first complexing tank further comprising an agitation system, an outlet, and a system for supplying controlled quantities of one or more predetermined bases and one or more predetermined chlortetracycline complexing compounds to produce complexed fermentation broth;

an acidification tank comprising an inlet for receiving said second quantity of the fermentation broth from the second outlet of said conduit, said acidification tank further comprising an agitation system, an outlet, and a system for supplying controlled quantities of one or more predetermined acids to said second quantity to produce acidified fermentation broth;

a solid separation device for removing solids from the acidified fermentation broth, said solid separation device comprising an inlet for receiving the acidified fermentation broth and an outlet for discharging a liquid containing dissolved chlortetracycline;

a first pump for directing said acidified fermentation broth from the outlet of said acidification tank to the inlet of said solid separation device;

a second complexing tank comprising an inlet for receiving said liquid containing dissolved chlortetracycline from the outlet of said solid separation device, said second complexing tank further comprising an agitation system, an

outlet, and a system for supplying controlled quantities of one or more predetermined chlortetracycline complexing compounds and one or more predetermined bases to said liquid containing dissolved chlortetracycline to produce a suspension of complexed chlortetracycline;

5 a second conduit, said second conduit connected to the outlet of said second complexing tank and the inlet of said first complexing tank, said second conduit for delivering the suspension of complexed chlortetracycline from said second complexing tank to said first complexing tank to produce a mixture of the complexed fermentation broth and the suspension of complexed chlortetracycline;

10 a liquid separation device for removing liquid from said mixture of the complexed fermentation broth and the suspension of complexed chlortetracycline to produce a wet cake comprising complexed chlortetracycline, said liquid separation device comprising an inlet for receiving the mixture of the complexed fermentation broth and the suspension of complexed chlortetracycline and an outlet for discharging the liquid;

15 a second pump for directing said mixture of the complexed fermentation broth and the suspension of complexed chlortetracycline from the outlet of said second complexing tank to the inlet of said liquid separation device;

20 a dryer for drying said wet cake to produce a low moisture content fermentation product; and

a sizing apparatus for producing particles from said low moisture content fermentation product, said particles having a predetermined size or range of sizes.

25 124. An apparatus according to claim 123, wherein said solid separation device comprises a filter press.

125. An apparatus according to claim 123, wherein said solid separation device comprises a filter press, a collection tank for receiving a filtrate from the

outlet of said filter press, and a conduit connected to an outlet of said collection tank for recirculating said filtrate to an inlet of said filter press.

126. An apparatus according to claim 123, wherein said liquid separation device comprises a filter press.

5 127. An apparatus according to claim 123, further comprising a blender for mixing said solid particles with a diluent.

128. An apparatus according to claim 127, wherein said diluent is selected from the group of an edible feed material, a mineral product, or both.

10 129. An apparatus according to claim 127, further comprising a spray apparatus for spraying said solid particles and said diluent with an oil.

130. An apparatus according to claim 123, further comprising a spray apparatus for spraying said solid particles with an oil.

131. An apparatus according to claim 123, wherein said chlortetracycline complexing compound added to said first quantity is calcium carbonate.

15 132. An apparatus according to claim 123, wherein said base added to said first quantity is aqueous ammonia.

133. An apparatus according to claim 123, wherein said acid is a mineral acid.

20 134. An apparatus according to claim 123, wherein said acid is selected from the group consisting of oxalic acid, hydrochloric acid, sulfuric acid, and any combination thereof.

135. An apparatus according to claim 123, wherein said acid is oxalic acid and hydrochloric acid.

25 136. An apparatus according to claim 123, wherein said chlortetracycline complexing compound added to said acidified fermentation broth is calcium carbonate.

137. An apparatus according to claim 123, wherein said base added to said acidified fermentation broth is aqueous ammonia.

138. An apparatus according to claim 123, wherein said dryer is one or more selected from the group consisting of an oven, tray dryer, tunnel dryer, spray dryer, spray granulator, fluid bed dryer, shelf dryer, drum dryer, rotary dryer, microwave dryer, and contact dryer.

5 139. An apparatus according to claim 123, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 30% to about 75%.

10 140. An apparatus according to claim 123, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 35% to about 65%.

141. An apparatus according to claim 123, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 44% to about 55%.

15 142. An apparatus according to claim 123, wherein said particles are in the form of a powder, meal, pellets, granules, or tablets.

143. An apparatus according to claim 123, wherein said particles have a diameter of from about 150  $\mu\text{m}$  to about 2 mm.

144. An apparatus according to claim 123, wherein said solid particles are produced without compression or compaction.

20 145. An apparatus according to claim 123, wherein said solid particles are produced with a compression or compaction.

25 146. An apparatus according to claim 123, further comprising a collection tank for receiving the liquid containing dissolved chlortetracycline from the outlet of said solid separation device and a conduit connected to an outlet of said collection tank for recirculating said liquid containing dissolved chlortetracycline to an inlet of said solid separation device.

147. An apparatus for the preparation of a chlortetracycline-containing animal feed composition from fermentation broth, said fermentation broth produced by fermentation of an organism producing chlortetracycline, said fermentation broth comprising chlortetracycline, fermentation solids and liquids, the apparatus comprising:

a first conduit comprising an inlet which connects to a first source of fermentation broth and an outlet, said first conduit for directing a first quantity of said fermentation broth to the outlet;

a second conduit comprising an inlet which connects to a second source of fermentation broth and an outlet, said second conduit for directing a second quantity of said fermentation broth to the outlet;

a first complexing tank comprising an inlet for receiving said first quantity of the fermentation broth from the outlet of said first conduit, said first complexing tank further comprising an agitation system, an outlet, and a system for supplying controlled quantities of one or more predetermined chlortetracycline complexing compounds and one or more predetermined bases to said first quantity to produce complexed fermentation broth;

an acidification tank comprising an inlet for receiving said second quantity of the fermentation broth from the outlet of said second conduit, said acidification tank further comprising an agitation system, an outlet, and a system for supplying controlled quantities of one or more predetermined acids to said second quantity to produce acidified fermentation broth;

a solid separation device for removing solids from the acidified fermentation broth, said solid separation device comprising an inlet for receiving the acidified fermentation broth and an outlet for discharging a liquid containing dissolved chlortetracycline;

a first pump for directing said acidified fermentation broth from the outlet of said acidification tank to the inlet of said solid separation device;

a second complexing tank comprising an inlet for receiving said liquid containing dissolved chlortetracycline from the outlet of said solid separation device, said second complexing tank further comprising an agitation system, an outlet, and a system for supplying controlled quantities of one or more predetermined chlortetracycline complexing compounds and one or more predetermined bases to said liquid containing dissolved chlortetracycline to produce a suspension of complexed chlortetracycline;

a third conduit, said third conduit connected to the outlet of said second complexing tank and the inlet of said first complexing tank, said third conduit for delivering the suspension of complexed chlortetracycline from said second complexing tank to said first complexing tank to produce a mixture of the complexed fermentation broth and the suspension of complexed chlortetracycline;

a liquid separation device for removing liquid from said mixture of the complexed fermentation broth and the suspension of complexed chlortetracycline to produce a wet cake comprising complexed chlortetracycline, said liquid separation device comprising an inlet for receiving the mixture of the complexed fermentation broth and the suspension of complexed chlortetracycline and an outlet for discharging the liquid;

a second pump for directing said mixture of the complexed fermentation broth and the suspension of complexed chlortetracycline from the outlet of said second complexing tank to the inlet of said liquid separation device;

a dryer for drying said wet cake to produce a solid having a low moisture content; and

a sizing apparatus for producing particles from said low moisture content fermentation product, said particles having a predetermined size or range of sizes.

148. An apparatus according to claim 147, wherein said solid separation device comprises a filter press.

149. An apparatus according to claim 147, wherein said solid separation device comprises a filter press, a collection tank for receiving a filtrate from the outlet of said filter press, and a conduit connected to an outlet of said collection tank for recirculating said filtrate to an inlet of said filter press.

5 150. An apparatus according to claim 147, wherein said liquid separation device comprises a filter press.

151. An apparatus according to claim 147, further comprising a blender for mixing said solid particles with a diluent.

10 152. An apparatus according to claim 151, wherein said diluent is selected from the group of an edible feed material, a mineral product, or both.

153. An apparatus according to claim 151, further comprising a spray apparatus for spraying said solid particles and said diluent with an oil.

154. An apparatus according to claim 147, further comprising a spray apparatus for spraying said solid particles with an oil.

15 155. An apparatus according to claim 147, wherein said chlortetracycline complexing compound added to said first quantity is calcium carbonate.

156. An apparatus according to claim 147, wherein said base added to said first quantity is aqueous ammonia.

20 157. An apparatus according to claim 147, wherein said acid is a mineral acid.

158. An apparatus according to claim 147, wherein said acid is selected from the group consisting of oxalic acid, hydrochloric acid, sulfuric acid, and any combination thereof.

25 159. An apparatus according to claim 147, wherein said acid is oxalic acid and hydrochloric acid.

160. An apparatus according to claim 147, wherein said chlortetracycline complexing compound added to said acidified fermentation broth is calcium carbonate.

161. An apparatus according to claim 147, wherein said base added to said acidified fermentation broth is aqueous ammonia.

162. An apparatus according to claim 147, wherein said dryer is one or more selected from the group consisting of an oven, tray dryer, tunnel dryer, spray dryer, spray granulator, fluid bed dryer, shelf dryer, drum dryer, rotary dryer, microwave dryer, and contact dryer.

163. An apparatus according to claim 147, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 30% to about 75%.

164. An apparatus according to claim 147, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 35% to about 65%.

165. An apparatus according to claim 147, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 44% to about 55%.

166. An apparatus according to claim 147, wherein said particles are in the form of a powder, meal, pellets, granules, or tablets.

167. An apparatus according to claim 147, wherein said particles have a diameter of from about 150  $\mu\text{m}$  to about 2 mm.

168. An apparatus according to claim 147, wherein said solid particles are produced without compression or compaction.

169. An apparatus according to claim 147, wherein said solid particles are produced with a compression or compaction.

170. An apparatus according to claim 147, further comprising a collection tank for receiving the liquid containing dissolved chlortetracycline from the outlet of said solid separation device and a conduit connected to an outlet of said collection tank for recirculating said liquid containing dissolved chlortetracycline to an inlet of said solid separation device.



171. An apparatus for the preparation of a chlortetracycline-containing animal feed composition from fermentation broth, said fermentation broth produced by fermentation of an organism producing chlortetracycline, said fermentation broth comprising chlortetracycline, fermentation solids and liquids, the apparatus comprising:

a first conduit comprising an inlet which connects to a source of fermentation broth, said conduit comprising a first outlet, a second outlet, and a control valve for directing a first quantity of said fermentation broth to said first outlet, and a second quantity of said fermentation broth to said second outlet;

a first precipitation tank comprising an inlet for receiving said first quantity of the fermentation broth from the first outlet of said conduit, said first precipitation tank further comprising an agitation system, an outlet, and a system for supplying controlled quantities of one or more predetermined bases to produce fermentation broth containing chlortetracycline in the free base form;

an acidification tank comprising an inlet for receiving said second quantity of the fermentation broth from the second outlet of said conduit, said acidification tank further comprising an agitation system, an outlet, and a system for supplying controlled quantities of one or more predetermined acids to said second quantity to produce acidified fermentation broth;

a solid separation device for removing solids from the acidified fermentation broth, said solid separation device comprising an inlet for receiving the acidified fermentation broth and an outlet for discharging a liquid containing dissolved chlortetracycline;

a first pump for directing said acidified fermentation broth from the outlet of said acidification tank to the inlet of said solid separation device;

a second precipitation tank comprising an inlet for receiving said liquid containing dissolved chlortetracycline from the outlet of said solid separation device, said second precipitation tank further comprising an agitation system, an outlet, and a system for supplying controlled quantities of one or more

predetermined bases to said liquid containing dissolved chlortetracycline to produce a suspension of chlortetracycline in the free base form;

5 a second conduit, said second conduit connected to the outlet of said second precipitation tank and the inlet of said first precipitation tank, said second conduit for delivering the suspension of chlortetracycline in the free base form from said second precipitation tank to said to said first precipitation tank to produce a mixture of the fermentation broth containing chlortetracycline in the free base form and the suspension of chlortetracycline in the free base form;

10 a liquid separation device for removing liquid from said mixture of the fermentation broth containing chlortetracycline in the free base form and the suspension of chlortetracycline in the free base form to produce a wet cake comprising chlortetracycline in the free base form, said liquid separation device comprising an inlet for receiving the mixture of the fermentation broth containing chlortetracycline in the free base form and the suspension of chlortetracycline in the free base form, and an outlet for discharging the liquid;

15 a second pump for directing said mixture of the fermentation broth containing chlortetracycline in the free base form and the suspension of chlortetracycline in the free base form from the outlet of said second precipitation tank to the inlet of said liquid separation device;

20 a dryer for drying said wet cake to produce a low moisture content fermentation product containing chlortetracycline in the free base form; and

25 a sizing apparatus for producing particles from said low moisture content fermentation product, said particles having a predetermined size or range of sizes.

172. An apparatus according to claim 171, wherein said solid separation device comprises a filter press.

173. An apparatus according to claim 171, wherein said solid separation device comprises a filter press, a collection tank for receiving a filtrate from the outlet of said filter press, and a conduit connected to an outlet of said collection tank for recirculating said filtrate to an inlet of said filter press.

5 174. An apparatus according to claim 171, wherein said liquid separation device comprises a filter press.

175. An apparatus according to claim 171, further comprising a blender for mixing said solid particles with a diluent.

10 176. An apparatus according to claim 175, wherein said diluent is selected from the group of an edible feed material, a mineral product, or both.

177. An apparatus according to claim 175, further comprising a spray apparatus for spraying said solid particles and said diluent with an oil.

178. An apparatus according to claim 171, further comprising a spray apparatus for spraying said solid particles with an oil.

15 179. An apparatus according to claim 171, wherein said base added to said first quantity is aqueous ammonia.

180. An apparatus according to claim 171, wherein said acid is a mineral acid.

20 181. An apparatus according to claim 171, wherein said acid is selected from the group consisting of oxalic acid, hydrochloric acid, sulfuric acid, and any combination thereof.

182. An apparatus according to claim 171, wherein said acid is oxalic acid and hydrochloric acid.

25 183. An apparatus according to claim 171, wherein said base added to said acidified fermentation broth is aqueous ammonia.

184. An apparatus according to claim 171, wherein said dryer is one or more selected from the group consisting of an oven, tray dryer, tunnel dryer, spray dryer, spray granulator, fluid bed dryer, shelf dryer, drum dryer, rotary dryer, microwave dryer, and contact dryer.

185. An apparatus according to claim 171, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 30% to about 75%.

186. An apparatus according to claim 171, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 35% to about 65%.

187. An apparatus according to claim 171, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 44% to about 55%.

188. An apparatus according to claim 171, wherein said particles are in the form of a powder, meal, pellets, granules, or tablets.

189. An apparatus according to claim 171, wherein said particles have a diameter of from about 150  $\mu\text{m}$  to about 2 mm.

190. An apparatus according to claim 171, wherein said solid particles are produced without compression or compaction.

191. An apparatus according to claim 171, wherein said solid particles are produced with a compression or compaction.

192. An apparatus according to claim 171, further comprising a collection tank for receiving the liquid containing dissolved chlortetracycline from the outlet of said solid separation device and a conduit connected to an outlet of said collection tank for recirculating said liquid containing dissolved chlortetracycline to an inlet of said solid separation device.

193. An apparatus for the preparation of a chlortetracycline-containing animal feed composition from fermentation broth, said fermentation broth produced by fermentation of an organism producing chlortetracycline, said fermentation broth comprising chlortetracycline, fermentation solids and liquids, the apparatus comprising:

a first conduit comprising an inlet which connects to a first source of fermentation broth and an outlet, said first conduit for directing a first quantity of said fermentation broth to the outlet;

a second conduit comprising an inlet which connects to a second source of fermentation broth and an outlet, said second conduit for directing a second quantity of said fermentation broth to the outlet;

a first precipitation tank comprising an inlet for receiving said first quantity of the fermentation broth from the outlet of said first conduit, said first precipitation tank further comprising an agitation system, an outlet, and a system for supplying controlled quantities of one or more predetermined bases to said first quantity to produce fermentation broth containing chlortetracycline in the free base form;

an acidification tank comprising an inlet for receiving said second quantity of the fermentation broth from the outlet of said second conduit, said acidification tank further comprising an agitation system, an outlet, and a system for supplying controlled quantities of one or more predetermined acids to said second quantity to produce acidified fermentation broth;

a solid separation device for removing solids from the acidified fermentation broth, said solid separation device comprising an inlet for receiving the acidified fermentation broth and an outlet for discharging a liquid containing dissolved chlortetracycline;

a first pump for directing said acidified fermentation broth from the outlet of said acidification tank to the inlet of said solid separation device;

a second precipitation tank comprising an inlet for receiving said liquid containing dissolved chlortetracycline from the outlet of said solid separation device, said second precipitation tank further comprising an agitation system, an outlet, and a system for supplying controlled quantities of one or more predetermined bases to said liquid containing dissolved chlortetracycline to produce a suspension of chlortetracycline in the free base form;

a third conduit, said third conduit connected to the outlet of said second precipitation tank and the inlet of said first precipitation tank, said third conduit for delivering the suspension of chlortetracycline in the free base form from said second precipitation tank to said first precipitation tank to produce a mixture of the fermentation broth containing chlortetracycline in the free base form and the suspension of chlortetracycline in the free base form;

a liquid separation device for removing liquid from said mixture of the fermentation broth containing chlortetracycline in the free base form and the suspension of chlortetracycline in the free base form to produce a wet cake comprising chlortetracycline in the free base form, said liquid separation device comprising an inlet for receiving the mixture of the fermentation broth containing chlortetracycline in the free base form and the suspension of chlortetracycline in the free base form and an outlet for discharging the liquid;

a second pump for directing said mixture of the fermentation broth containing chlortetracycline in the free base form and the suspension of chlortetracycline in the free base form from the outlet of said second precipitation tank to the inlet of said liquid separation device;

a dryer for drying said wet cake to produce a solid having a low moisture content; and

a sizing apparatus for producing particles from said low moisture content fermentation product, said particles having a predetermined size or range of sizes.

194. An apparatus according to claim 193, wherein said solid separation device comprises a filter press.

195. An apparatus according to claim 193, wherein said solid separation device comprises a filter press, a collection tank for receiving a filtrate from the outlet of said filter press, and a conduit connected to an outlet of said collection tank for recirculating said filtrate to an inlet of said filter press.

196. An apparatus according to claim 193, wherein said liquid separation device comprises a filter press.

197. An apparatus according to claim 193, further comprising a blender for mixing said solid particles with a diluent.

198. An apparatus according to claim 197, wherein said diluent is selected from the group of an edible feed material, a mineral product, or both.

199. An apparatus according to claim 197, further comprising a spray apparatus for spraying said solid particles and said diluent with an oil.

200. An apparatus according to claim 193, further comprising a spray apparatus for spraying said solid particles with an oil.

201. An apparatus according to claim 193, wherein said base added to said first quantity is aqueous ammonia.

202. An apparatus according to claim 193, wherein said acid is a mineral acid.

203. An apparatus according to claim 193, wherein said acid is selected from the group consisting of oxalic acid, hydrochloric acid, sulfuric acid, and any combination thereof.

204. An apparatus according to claim 193, wherein said acid is oxalic acid and hydrochloric acid.

205. An apparatus according to claim 193, wherein said base added to said acidified fermentation broth is aqueous ammonia.

206. An apparatus according to claim 193, wherein said dryer is one or more selected from the group consisting of an oven, tray dryer, tunnel dryer, spray

dryer, spray granulator, fluid bed dryer, shelf dryer, drum dryer, rotary dryer, microwave dryer, and contact dryer.

207. An apparatus according to claim 193, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 30% to about 75%.

208. An apparatus according to claim 193, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 35% to about 65%.

209. An apparatus according to claim 193, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 44% to about 55%.

210. An apparatus according to claim 193, wherein said particles are in the form of a powder, meal, pellets, granules, or tablets.

211. An apparatus according to claim 193, wherein said particles have a diameter of from about 150  $\mu\text{m}$  to about 2 mm.

212. An apparatus according to claim 193, wherein said solid particles are produced without compression or compaction.

213. An apparatus according to claim 193, wherein said solid particles are produced with a compression or compaction.

214. An apparatus according to claim 193, further comprising a collection tank for receiving the liquid containing dissolved chlortetracycline from the outlet of said solid separation device and a conduit connected to an outlet of said collection tank for recirculating said liquid containing dissolved chlortetracycline to an inlet of said solid separation device.



215. An apparatus for the preparation of a chlortetracycline-containing animal feed composition from fermentation broth, said fermentation broth produced by fermentation of an organism producing chlortetracycline, said fermentation broth comprising chlortetracycline, fermentation solids and liquids, the apparatus comprising:

a first conduit comprising an inlet which connects to a source of fermentation broth, said conduit comprising a first outlet, a second outlet, and a control valve for directing a first quantity of said fermentation broth to said first outlet, and a second quantity of said fermentation broth to said second outlet;

an acidification tank comprising an inlet for receiving said second quantity of the fermentation broth from the second outlet of said conduit, said acidification tank further comprising an agitation system, an outlet, and a system for supplying controlled quantities of one or more predetermined acids to said second quantity to produce acidified fermentation broth;

a solid separation device for removing solids from the acidified fermentation broth, said solid separation device comprising an inlet for receiving the acidified fermentation broth and an outlet for discharging a liquid containing dissolved chlortetracycline;

a first pump for directing said acidified fermentation broth from the outlet of said acidification tank to the inlet of said solid separation device;

a complexing tank comprising a first inlet for receiving said first quantity of the fermentation broth from the first outlet of said conduit, and a second inlet for receiving said liquid containing dissolved chlortetracycline from the outlet of said solid separation device, said complexing tank further comprising an agitation system, an outlet, and a system for supplying controlled quantities of one or more predetermined chlortetracycline complexing compounds and one or more predetermined bases to produce a mixture containing complexed chlortetracycline;

a liquid separation device for removing liquid from said mixture containing complexed chlortetracycline to produce a wet cake comprising complexed chlortetracycline, said liquid separation device comprising an inlet for receiving said mixture containing complexed chlortetracycline and an outlet for discharging the liquid;

a second pump for directing said mixture containing complexed chlortetracycline from the outlet of said second complexing tank to the inlet of said liquid separation device;

a dryer for drying said wet cake to produce a low moisture content fermentation product; and

a sizing apparatus for producing particles from said low moisture content fermentation product, said particles having a predetermined size or range of sizes.

216. An apparatus according to claim 215, wherein said solid separation device comprises a filter press.

217. An apparatus according to claim 215, wherein said solid separation device comprises a filter press, a collection tank for receiving a filtrate from the outlet of said filter press, and a conduit connected to an outlet of said collection tank for recirculating said filtrate to an inlet of said filter press.

218. An apparatus according to claim 215, wherein said liquid separation device comprises a filter press.

219. An apparatus according to claim 215, further comprising a blender for mixing said solid particles with a diluent.

220. An apparatus according to claim 219, wherein said diluent is selected from the group of an edible feed material, a mineral product, or both.

221. An apparatus according to claim 219, further comprising a spray apparatus for spraying said solid particles and said diluent with an oil.

222. An apparatus according to claim 215, further comprising a spray apparatus for spraying said solid particles with an oil.

223. An apparatus according to claim 215, wherein said chlortetracycline complexing compound is calcium carbonate.

224. An apparatus according to claim 215, wherein said base is aqueous ammonia.

5 225. An apparatus according to claim 215, wherein said acid is a mineral acid.

226. An apparatus according to claim 215, wherein said acid is selected from the group consisting of oxalic acid, hydrochloric acid, sulfuric acid, and any combination thereof.

10 227. An apparatus according to claim 215, wherein said acid is oxalic acid and hydrochloric acid.

228. An apparatus according to claim 215, wherein said dryer is one or more selected from the group consisting of an oven, tray dryer, tunnel dryer, spray dryer, spray granulator, fluid bed dryer, shelf dryer, drum dryer, rotary dryer, microwave dryer, and contact dryer.

229. An apparatus according to claim 215, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 30% to about 75%.

230. An apparatus according to claim 215, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 35% to about 65%.

231. An apparatus according to claim 215, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 44% to about 55%.

25 232. An apparatus according to claim 215, wherein said particles are in the form of a powder, meal, pellets, granules, or tablets.

233. An apparatus according to claim 215, wherein said particles have a diameter of from about 150  $\mu\text{m}$  to about 2 mm.

234. An apparatus according to claim 215, wherein said solid particles are produced without compression or compaction.

235. An apparatus according to claim 215, wherein said solid particles are produced with a compression or compaction.

5 236. An apparatus according to claim 215, further comprising a collection tank for receiving the liquid containing dissolved chlortetracycline from the outlet of said solid separation device and a conduit connected to an outlet of said collection tank for recirculating said liquid containing dissolved chlortetracycline to an inlet of said solid separation device.

237. An apparatus for the preparation of a chlortetracycline-containing animal feed composition from fermentation broth, said fermentation broth produced by fermentation of an organism producing chlortetracycline, said fermentation broth comprising chlortetracycline, fermentation solids and liquids, the apparatus comprising:

a first conduit comprising an inlet which connects to a first source of fermentation broth and an outlet, said first conduit for directing a first quantity of said fermentation broth to the outlet;

a second conduit comprising an inlet which connects to a second source of fermentation broth and an outlet, said second conduit for directing a second quantity of said fermentation broth to the outlet;

an acidification tank comprising an inlet for receiving said second quantity of the fermentation broth from the outlet of said second conduit, said acidification tank further comprising an agitation system, an outlet, and a system for supplying controlled quantities of one or more predetermined acids to said second quantity to produce acidified fermentation broth;

a solid separation device for removing solids from the acidified fermentation broth, said solid separation device comprising an inlet for receiving the acidified fermentation broth and an outlet for discharging a liquid containing dissolved chlortetracycline;

a first pump for directing said acidified fermentation broth from the outlet of said acidification tank to the inlet of said solid separation device;

a complexing tank comprising a first inlet for receiving said first quantity of the fermentation broth from the first outlet of said conduit, and a second inlet for receiving said liquid containing dissolved chlortetracycline from the outlet of said solid separation device, said complexing tank further comprising an agitation system, an outlet, and a system for supplying controlled quantities of one or more predetermined chlortetracycline complexing compounds and

one or more predetermined bases to produce a mixture containing complexed chlortetracycline;

5 a liquid separation device for removing liquid from said mixture containing complexed chlortetracycline to produce a wet cake comprising complexed chlortetracycline, said liquid separation device comprising an inlet for receiving the mixture containing complexed chlortetracycline and an outlet for discharging the liquid;

10 a second pump for directing said mixture containing complexed chlortetracycline from the outlet of said second complexing tank to the inlet of said liquid separation device;

a dryer for drying said wet cake to produce a solid having a low moisture content; and

15 a sizing apparatus for producing particles from said low moisture content fermentation product, said particles having a predetermined size or range of sizes.

238. An apparatus according to claim 237, wherein said solid separation device comprises a filter press.

239. An apparatus according to claim 237, wherein said solid separation device comprises a filter press, a collection tank for receiving a filtrate from the outlet of said filter press, and a conduit connected to an outlet of said collection tank for recirculating said filtrate to an inlet of said filter press.

240. An apparatus according to claim 237, wherein said liquid separation device comprises a filter press.

25 241. An apparatus according to claim 237, further comprising a blender for mixing said solid particles with a diluent.

242. An apparatus according to claim 241, wherein said diluent is selected from the group of an edible feed material, a mineral product, or both.

243. An apparatus according to claim 241, further comprising a spray apparatus for spraying said solid particles and said diluent with an oil.

244. An apparatus according to claim 237, further comprising a spray apparatus for spraying said solid particles with an oil.

245. An apparatus according to claim 237, wherein said chlortetracycline complexing compound is calcium carbonate.

5 246. An apparatus according to claim 237, wherein said base is aqueous ammonia.

247. An apparatus according to claim 237, wherein said acid is a mineral acid.

10 248. An apparatus according to claim 237, wherein said acid is selected from the group consisting of oxalic acid, hydrochloric acid, sulfuric acid, and any combination thereof.

249. An apparatus according to claim 237, wherein said acid is oxalic acid and hydrochloric acid.

15 250. An apparatus according to claim 237, wherein said dryer is one or more selected from the group consisting of an oven, tray dryer, tunnel dryer, spray dryer, spray granulator, fluid bed dryer, shelf dryer, drum dryer, rotary dryer, microwave dryer, and contact dryer.

20 251. An apparatus according to claim 237, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 30% to about 75%.

252. An apparatus according to claim 237, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 35% to about 65%.

25 253. An apparatus according to claim 237, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 44% to about 55%.

254. An apparatus according to claim 237, wherein said particles are in the form of a powder, meal, pellets, granules, or tablets.

255. An apparatus according to claim 237, wherein said particles have a diameter of from about 150  $\mu\text{m}$  to about 2 mm.

256. An apparatus according to claim 237, wherein said solid particles are produced without compression or compaction.

5 257. An apparatus according to claim 237, wherein said solid particles are produced with a compression or compaction.

258. An apparatus according to claim 237, further comprising a collection tank for receiving the liquid containing dissolved chlortetracycline from the outlet of said solid separation device and a conduit connected to an outlet of said collection tank for recirculating said liquid containing dissolved chlortetracycline to an inlet of said solid separation device.

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259. An apparatus for the preparation of a chlortetracycline-containing animal feed composition from fermentation broth, said fermentation broth produced by fermentation of an organism producing chlortetracycline, said fermentation broth comprising chlortetracycline, fermentation solids and liquids, the apparatus comprising:

a first conduit comprising an inlet which connects to a source of fermentation broth, said conduit comprising a first outlet, a second outlet, and a control valve for directing a first quantity of said fermentation broth to said first outlet, and a second quantity of said fermentation broth to said second outlet;

an acidification tank comprising an inlet for receiving said second quantity of the fermentation broth from the second outlet of said conduit, said acidification tank further comprising an agitation system, an outlet, and a system for supplying controlled quantities of one or more predetermined acids to said second quantity to produce acidified fermentation broth;

a solid separation device for removing solids from the acidified fermentation broth, said solid separation device comprising an inlet for receiving the acidified fermentation broth and an outlet for discharging a liquid containing dissolved chlortetracycline;

a first pump for directing said acidified fermentation broth from the outlet of said acidification tank to the inlet of said solid separation device;

a complexing tank comprising a first inlet for receiving said first quantity of the fermentation broth from the first outlet of said conduit, and a second inlet for receiving said liquid containing dissolved chlortetracycline from the outlet of said solid separation device, said complexing tank further comprising an agitation system, an outlet, and a system for supplying controlled quantities of one or more predetermined bases to produce a mixture containing chlortetracycline in the free base form;

a liquid separation device for removing liquid from said mixture containing chlortetracycline in the free base form to produce a wet cake comprising

chlortetracycline in the free base form, said liquid separation device comprising an inlet for receiving the mixture containing chlortetracycline in the free base form, and an outlet for discharging the liquid;

5 a second pump for directing said mixture containing chlortetracycline in the free base form from the outlet of said second precipitation tank to the inlet of said liquid separation device;

a dryer for drying said wet cake to produce a low moisture content fermentation product containing chlortetracycline in the free base form; and

10 a sizing apparatus for producing particles from said low moisture content fermentation product, said particles having a predetermined size or range of sizes.

260. An apparatus according to claim 259, wherein said solid separation device comprises a filter press.

15 261. An apparatus according to claim 259, wherein said solid separation device comprises a filter press, a collection tank for receiving a filtrate from the outlet of said filter press, and a conduit connected to an outlet of said collection tank for recirculating said filtrate to an inlet of said filter press.

262. An apparatus according to claim 259, wherein said liquid separation device comprises a filter press.

20 263. An apparatus according to claim 259, further comprising a blender for mixing said solid particles with a diluent.

264. An apparatus according to claim 263, wherein said diluent is selected from the group of an edible feed material, a mineral product, or both.

25 265. An apparatus according to claim 263, further comprising a spray apparatus for spraying said solid particles and said diluent with an oil.

266. An apparatus according to claim 259, further comprising a spray apparatus for spraying said solid particles with an oil.

267. An apparatus according to claim 259, wherein said base is aqueous ammonia.

268. An apparatus according to claim 259, wherein said acid is a mineral acid.

269. An apparatus according to claim 259, wherein said acid is selected from the group consisting of oxalic acid, hydrochloric acid, sulfuric acid, and any combination thereof.

270. An apparatus according to claim 259, wherein said acid is oxalic acid and hydrochloric acid.

271. An apparatus according to claim 259, wherein said dryer is one or more selected from the group consisting of an oven, tray dryer, tunnel dryer, spray dryer, spray granulator, fluid bed dryer, shelf dryer, drum dryer, rotary dryer, microwave dryer, and contact dryer.

272. An apparatus according to claim 259, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 30% to about 75%.

273. An apparatus according to claim 259, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 35% to about 65%.

274. An apparatus according to claim 259, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 44% to about 55%.

275. An apparatus according to claim 259, wherein said particles are in the form of a powder, meal, pellets, granules, or tablets.

276. An apparatus according to claim 259, wherein said particles have a diameter of from about 150  $\mu$ m to about 2 mm.

277. An apparatus according to claim 259, wherein said solid particles are produced without compression or compaction.

278. An apparatus according to claim 259, wherein said solid particles are produced with a compression or compaction.

279. An apparatus according to claim 259, further comprising a collection tank for receiving the liquid containing dissolved chlortetracycline from the outlet of said solid separation device and a conduit connected to an outlet of said collection tank for recirculating said liquid containing dissolved chlortetracycline to an inlet of said solid separation device.

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279. An apparatus according to claim 259, further comprising a collection tank for receiving the liquid containing dissolved chlortetracycline from the outlet of said solid separation device and a conduit connected to an outlet of said collection tank for recirculating said liquid containing dissolved chlortetracycline to an inlet of said solid separation device.

280. An apparatus for the preparation of a chlortetracycline-containing animal feed composition from fermentation broth, said fermentation broth produced by fermentation of an organism producing chlortetracycline, said fermentation broth comprising chlortetracycline, fermentation solids and liquids, the apparatus comprising:

a first conduit comprising an inlet which connects to a first source of fermentation broth and an outlet, said first conduit for directing a first quantity of said fermentation broth to the outlet;

a second conduit comprising an inlet which connects to a second source of fermentation broth and an outlet, said second conduit for directing a second quantity of said fermentation broth to the outlet;

an acidification tank comprising an inlet for receiving said second quantity of the fermentation broth from the outlet of said second conduit, said acidification tank further comprising an agitation system, an outlet, and a system for supplying controlled quantities of one or more predetermined acids to said second quantity to produce acidified fermentation broth;

a solid separation device for removing solids from the acidified fermentation broth, said solid separation device comprising an inlet for receiving the acidified fermentation broth and an outlet for discharging a liquid containing dissolved chlortetracycline;

a first pump for directing said acidified fermentation broth from the outlet of said acidification tank to the inlet of said solid separation device;

a complexing tank comprising a first inlet for receiving said first quantity of the fermentation broth from the first outlet of said conduit, and a second inlet for receiving said liquid containing dissolved chlortetracycline from the outlet of said solid separation device, said complexing tank further comprising an agitation system, an outlet, and a system for supplying controlled quantities of one or more predetermined bases to produce a mixture containing chlortetracycline in the free base form;

a second conduit, said second conduit connected to the outlet of said second precipitation tank and the inlet of said first precipitation tank, said second conduit for delivering the suspension of chlortetracycline in the free base form from said second precipitation tank to said first precipitation tank to produce a mixture containing chlortetracycline in the free base form;

a liquid separation device for removing liquid from said mixture containing chlortetracycline in the free base form to produce a wet cake comprising chlortetracycline in the free base form, said liquid separation device comprising an inlet for receiving the mixture containing chlortetracycline in the free base form and an outlet for discharging the liquid;

a second pump for directing said mixture containing chlortetracycline in the free base form from the outlet of said second precipitation tank to the inlet of said liquid separation device;

a dryer for drying said wet cake to produce a solid having a low moisture content; and

a sizing apparatus for producing particles from said low moisture content fermentation product, said particles having a predetermined size or range of sizes.

281. An apparatus according to claim 280, wherein said solid separation device comprises a filter press.

282. An apparatus according to claim 280, wherein said solid separation device comprises a filter press, a collection tank for receiving a filtrate from the outlet of said filter press, and a conduit connected to an outlet of said collection tank for recirculating said filtrate to an inlet of said filter press.

283. An apparatus according to claim 280, wherein said liquid separation device comprises a filter press.

284. An apparatus according to claim 280, further comprising a blender for mixing said solid particles with a diluent.

285. An apparatus according to claim 284, wherein said diluent is selected from the group of an edible feed material, a mineral product, or both.

286. An apparatus according to claim 284, further comprising a spray apparatus for spraying said solid particles and said diluent with an oil.

5 287. An apparatus according to claim 280, further comprising a spray apparatus for spraying said solid particles with an oil.

288. An apparatus according to claim 280, wherein said base is aqueous ammonia.

10 289. An apparatus according to claim 280, wherein said acid is a mineral acid.

290. An apparatus according to claim 280, wherein said acid is selected from the group consisting of oxalic acid, hydrochloric acid, sulfuric acid, and any combination thereof.

15 291. An apparatus according to claim 280, wherein said acid is oxalic acid and hydrochloric acid.

292. An apparatus according to claim 280, wherein said dryer is one or more selected from the group consisting of an oven, tray dryer, tunnel dryer, spray dryer, spray granulator, fluid bed dryer, shelf dryer, drum dryer, rotary dryer, microwave dryer, and contact dryer.

20 293. An apparatus according to claim 280, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 30% to about 75%.

25 294. An apparatus according to claim 280, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 35% to about 65%.

295. An apparatus according to claim 280, wherein said solid having low moisture content comprises chlortetracycline in an amount from about 44% to about 55%.

296. An apparatus according to claim 280, wherein said particles are in the form of a powder, meal, pellets, granules, or tablets.

297. An apparatus according to claim 280, wherein said particles have a diameter of from about 150  $\mu\text{m}$  to about 2 mm.

5 298. An apparatus according to claim 280, wherein said solid particles are produced without compression or compaction.

299. An apparatus according to claim 280, wherein said solid particles are produced with a compression or compaction.

10 300. An apparatus according to claim 280, further comprising a collection tank for receiving the liquid containing dissolved chlortetracycline from the outlet of said solid separation device and a conduit connected to an outlet of said collection tank for recirculating said liquid containing dissolved chlortetracycline to an inlet of said solid separation device.



301. A method of combating microbial infection in animals comprising orally administering to said animals a prophylactic or therapeutic amount of an animal comestible composition comprising a medicated supplement prepared by culturing an organism producing an antibiotic in a fermentation medium to produce a fermentation broth; reducing said fermentation broth to obtain fermentation solids comprising said antibiotic; drying said filtration solids to produce a dry solid; and granulating said dry solid to produce granulated fermentation solids comprising uncompacted granules having a substantially uniform particle size.

302. The method as described in claim 301, wherein the granules have an antimicrobial concentration of at least 10 g/lb.

303. The method as described in claim 302, wherein the granules have an antimicrobial concentration to about 300 g/lb.

304. The method as described in claim 302, wherein the granules have an antimicrobial concentration to about 200 g/lb.

305. The method as described in claim 301, wherein the granules have an antimicrobial concentration to about 300 g/lb.

306. The method as described in claim 301, wherein the granules have an antimicrobial concentration to about 200 g/lb.

307. The method as described in claim 301, wherein the dry solid has a moisture content from about 3% to about 10%.

308. The method as described in claim 301, wherein the dry solid has a moisture content from about 4% to about 6%.

309. The method as described in claim 301, wherein the particle size ranges from about 80 mesh to about 10 mesh.

310. The method as described in claim 301, wherein the particle size is at least about 10 mesh.

311. A process for the production of a particulate, substantially dustless animal feed supplement comprising the steps of: culturing an organism producing

an antibiotic in a fermentation medium to produce a fermentation broth; reducing said fermentation broth to obtain fermentation solids comprising said antibiotic; drying said filtration solids to produce a dry solid; granulating said dry solid to produce granulated fermentation solids comprising granules having a substantially uniform particle size; and blending said granulated fermentation solids with an edible feed material and a mineral product.

312. A process of claim 311, further comprising the step of blending said granulated fermentation solids with at least one potency standardizer.

313. A process of claim 311, further comprising the step of blending said granulated fermentation solids with an edible oil.

314. A process of claim 311, further comprising adding an additional quantity of said antibiotic to the fermentation broth to increase the antibiotic activity of said fermentation broth.

315. A process for the production of a particulate medicated animal supplement comprising the steps of:

culturing an organism producing an antibiotic in a first fermentation medium to produce a fermentation broth;

reducing said fermentation broth to obtain fermentation solids comprising said antibiotic;

drying said filtration solids to produce a dry solid;

granulating said dry solid to produce granulated fermentation solids;

screening the granulated fermentation solids to arrive at a first group of granulated solids corresponding to a desired mesh size and a second group of solids which do not correspond with the desired mesh size; and

adding the second group of solids to a second fermentation broth having an organism producing an antibiotic in a second fermentation medium.

316. The process of claim 315, further comprising: reducing said second fermentation broth to obtain a third group of fermentation solids comprising said

antibiotic; drying said third group of filtration solids to produce a dry solid; and granulating said dry solid to produce granulated fermentation solids.

317. The process as described in claim 315, wherein the granules have an antimicrobial concentration of at least 10 g/lb.

5 318. The process as described in claim 315, wherein the granules have an antimicrobial concentration to about 300 g/lb.

319. The process as described in claim 315, wherein the granules have an antimicrobial concentration to about 200 g/lb.

10 320. The process as described in claim 315, wherein the dry solid has a moisture content from about 3% to about 10%.

321. The process as described in claim 315, wherein the first group particle size ranges from about 80 mesh to about 10 mesh.